ENGAGING LEARNING WITH AUGMENTED REALITY FOR PRIMARY SCHOOL SCIENCE EDUCATION

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Bachelor Of Computer Science (Graphic & Multimedia Technology)With Honors

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Graphics and Multimedia Technology).

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Realiti Berperantara (AR) merupakan salah satu teknologi visualisasi yang semakin mendapat perhatian dalam semua bidang, terutamanya dalam bidang pendidikan. AR telah diaplikasikan di dalam bidang pendidikan untuk menghasilkan pengalaman pembelajaran yang unik. Pelajar di awal pendidikan cenderung untuk mengalami kesukaran dalam memahami konsep pembelajaran sains yang abstrak. Dengan memperkenalkan AR dalam bilik darjah, AR boleh berfungsi sebagai material yang berkesan untuk menambah kefahaman pelajar disebabkan oleh AR boleh menawarkan pembelajaran yang kaya dengan media. Oleh itu, tujuan projek ini adalah untuk membangunkan satu aplikasi AR Sains untuk pelajar sekolah rendah. Selain memaparkan setiap process yang berkenaan**,** pelajar juga dapat visualisasi konsep sains dalam process pembelajaran. Tiga aplikasi AR yang sedia ada dalam bidang pendidikan telah dikaji untuk menghasilkan versi aplikasi yang lebih baik. Model ADDIE telah dipilih untuk membangunkan aplikasi ini. Terdapat lima fasa yang terlibat dalam model ini untuk memastikan rekabentuk dan pembagunan aplikasi mencapai objektif yang dicadangkan. Aplikasi yang dibangunkan dinilai oleh guru dan pelajar sekolah rendah untuk menentukan keberkesanannya dan persepsi terhadap aplikasi tersebut. Dalam kaji selidik yang dijalankan mendapati pelajar memberikan reaksi yang positif dan bersetuju aplikasi ini mampu meningkatkan kefahaman mereka dalam subjek sains.

ABSTRACT

Augmented Reality (AR) is one of the visualization technologies that gradually gaining considerable attention in every field, especially in education area. AR have been applying in education field to create a unique learning experience. In early age of education, primary school students have trouble grasping and understanding the abstract science concept. By bringing the AR into the classroom, AR can serve as an effective tool to gain understanding since AR offer rich media learning. Therefore, the purpose of this project is to design and develop a Science AR application for primary school students. Besides displaying each process upon presentation of its corresponding marker, students can visualize the concept of science in process of learning. Three existing application of AR in the field of education has been review to produce a better version of application. ADDIE model has been chosen in development of this application. There were five phases involved in the model to make sure that the designing and developing of the application has achieves the proposed objective. The application was evaluated by the teacher and primary school students to investigate its effectiveness and user perception toward the application. The result showed that students give positive feedback and they agree this application can improved their understanding in science subject.

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LIST OF ABBREVIATIONS

AR	Augmented Reality
GB	Gigabyte
GPS	Global Positioning System
GUI	Graphical User Interface
IOS	Internetwork Operating System
LDD	Low Level Design
MB	Megabyte
OS	Operating System
SDLC	System Development Life Cycle
SDK	Software Development Kit
SLAM	Simultaneous Location and Mapping
STEM	Science Technology Education and Mathematics
TIMSS	Trends in International Mathematical Science Study
UAT	User Acceptance Test
UTP	Unit Test Plan
2D	Two dimension
3D	Three dimension

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Over the last two decades, Augmented Reality (AR) have been receiving attention. AR can be defined as a human machine interaction tools for computer generated an information to the real world environment. AR is an innovative technology that able to supplement a real world environment with computer to generated sensory inputs. These virtual component seem to coexist with the real one in the same spaces, enhances the user perception of reality and enriching the information. The AR technologies has been firstly used for the training pilots in year 1990s and have been start used in CAD programs for education in learning process, military, medicine, engineering design, robotic, telerobotic, manufacturing, maintenance and repair applications, consumer design, psychological treatments, etc. (Azuma & Behringer., 2001).

AR have been applying in education field to create a unique educational learning. According to the 2016 Horizon Reports, AR with its information over 3-Dimensional (3D) spaces can create a new experienced and recommended that AR technologies should be applied to bring new opportunities for teaching, learning technique, research and creative inquiry (Becker et al., 2016). Following the trend of technology development today, a few educational studies aim to examine what role AR, a technique of blending virtual information with real environment in real time (Cheng, 2017). AR has been touted as one of the most attractive technologies for education, being powerful and motivating tool which involve combination of sound, sight and touch (Cascales, Laguna, Pérez-López, Perona, & Contero, 2012). For the generation that raised in interactive technologies, bringing AR technology into

classroom is effective in maintaining a high level of motivation and engagement among student (JessicaWenke, 2016).

Learning experience is important in teaching and learning process for primary education due to student in age 7 – 12 need to gain more attention to increase motivation and satisfaction in classroom (Pérez-López & Contero, 2013). In this project, an AR application for educational purposes, more specifically in Science education for primary school are developed. This application has potential to grab attention for the students in learning process. It also potential to engage and motivate learners to explore material from different perspectives. It allows the demonstration of spatial relationships and the interactions of elements within a 3D space. Student can easily understand on what they are learning with the real experiences.

1.2 PROBLEM STATEMENTS

With enhancement in education, traditional ways of education are not efficient. The process of teaching and learning in primary school used conventional method such as using chalk to write, textbook and graphic to explain (Perlis, 2018). Textbook play a traditional role in science classroom (Ding, 2014). Teachers used a textbook only to help student read the topic being taught. But textbook reading only is not enough to encourage students learn well. Students need to imagines themselves in real world environment of the chapter they studying. A study revealed that many students disagrees with the methods of teaching that only focused on the textbook. It was found that many teachers focused on memorizing rather than making student to understand (Rasmy, Selvadurai, & Sulehan, 2017). Teacher not only need to find the research-based problems suitable for their classes but also need pedagogical support in implement the problems (Virtanen, 2014). With AR application, most student able to remember and retain the knowledge in the topic that were taught (Rasalingam, Muniandy, & Rasalingam, 2014).

According to the survey conducted in 2017, it revealed that the number of students enrol in STEM (Science, Technology, Education and Mathematics) subjects are declining. Asean Academy of Engineering and Technology honorary president

Datuk Hong Lee Pee said the number of students taking pure science classes are now less than 21% compared with 50% in the past (Nation, 2017). The teacher said that, most students are not naturally interest in STEM (Madeline Will, 2017). Due to this phenomena the result in science subject was decline. According to study reported in TIMSS (Trends in International Mathematical Science Study) result from 1999 (before PPSMI was introduced) to 2015 (after PPSMI ended), declined drastically compared with other countries. Although students' Science achievement in PISA (Programme for International Student Assessment) rose from 53rd place in 2012 (421) to 48th place in 2015 (443) and, in Mathematics, rose from 52nd place in 2012 (420) to 46th place in 2015 (446), it is still below the international average in the teaching of Science and Mathematics (Madeline Will, 2017).

In early age of education, students are difficult in understanding the concept of science especially in learning the nature of conceptual of science process (Srisawasdi & Wangsomnuk, 2015). In science curriculum, the water cycle, Photosynthesis and butterfly life cycle concepts are the topics that were first introduce in primary education and further until secondary education. These topics has been raises a number challenges in learning and teaching process due to its conceptual difficulty, leading lack of interest and misconceptions among students. Students are difficult in visualising the process, or relating it to things they can see (Russell, Netherwood, & Robinson, 2015). With AR technology, students can visualize the process by combining virtual information with real world information that can provide users with access to rich and meaningful multimedia content (Srisawasdi & Wangsomnuk, 2015). Table 1.1 shows the summary of problems that faced by student in sciences education.

REFERENCES

Azuma, R., & Behringer. (2001). Recent Advances in Augmented Reality. *IEEE Computer Graphics and Applications, 2011*(December), 1–27. https://doi.org/10.4061/2011/908468

Becker, A. S., Freeman, A., Giesinger Hall, C., Cummins, M., & Yuhnke, B. (2016). *NMC / CoSN Horizon Report > 2016 K-12 Edition*. https://doi.org/10.1007/s00345-011-0808-7

Bhorkar, G. (2017). A Survey of Augmented Reality Navigation, (December 2014). https://doi.org/10.1561/1100000049

Cascales, A., Laguna, I., Pérez-López, D., Perona, P., & Contero, M. (2012). Augmented Reality for preschoolers: An experience around Natural Sciences educational contents. *Spdece*, (June), 113–122.

Cheng, K. H. (2017). Reading an augmented reality book: An exploration of learners' cognitive load, motivation, and attitudes. *Australasian Journal of Educational Technology*, *33*(4), 53–69. https://doi.org/10.14742/ajet.2820

Ćuković, S., Gattullo, M., Pankratz, F., & Devedžić, G. (2015). Marker Based vs . Natural Feature Tracking Augmented Reality Visualization of the 3D Foot Phantom Marker Based vs . Natural Feature Tracking Augmented Reality Visualization of the 3D Foot Phantom, (250).

Davis, J. J. (2017). Marker and Markerless Augmented Reality.

Ding, L. I. N. (2014). Long live traditional textbook problems!? — constraints on faculty use of research-based problems in introductory courses, (October 2012), 2005–2006. https://doi.org/10.1007/s10763-013-9400-5

Howell, K. E. (2013). Introduction to the Philosophy of Methodology.

JessicaWenke. (2016). The Benefits of Using Augmented Reality in Early Childhood Education. Retrieved from https://www.teq.com/technology/benefits-using-augmented-reality-early-childhood-education/

Katiyar, A., Kalra, K., & Garg, C. (2015). Marker Based Augmented Reality. *Advances in Computer Science and Information Technology*, *2*(5), 441–445.

Lee, K. (2012). Augmented Reality in Education and Training. *TechTrends*, *56*(2), 13–21. https://doi.org/10.1007/s11528-012-0559-3

Liarokapis, F., & Freitas, S. De. (2010). A Case Study of Augmented Reality Serious Games. *Learning*, 1–16. https://doi.org/10.4018/978-1-61520-678-0.ch010

Madeline Will. (2017). Most Student Are Not Naturally Interest in STEM,Teacher Said.

Matthias M.Wolka, B. G. A. (1995). Resolving occlusion in Augmented Reality, 5–12.

Mehmet Kesim, Y. O. (2012). Augmented reality in education: current technologies and the potential for education, 297–302.

Nation. (2017). Students taking up STEM subjects on decline last 10 years. *The Star Online*. Retrieved from https://www.thestar.com.my/news/nation/2017/07/16/students-taking-up-stem-subjects-on-decline-last-10-years-ratio-of-science-to-arts-classes-reversed/

Palmarini, R., Ahmet, J., Roy, R., & Torabmostaedi, H. (2018). Robotics and Computer – Integrated Manufacturing A systematic review of augmented reality applications in maintenance. *Robotics and Computer Integrated Manufacturing*, *49*(March 2017), 215–228. https://doi.org/10.1016/j.rcim.2017.06.002

Pérez-López, D., & Contero, M. (2013). Delivering educational multimedia contents through an augmented reality application: A case study on its impact on knowledge acquisition and retention. *Turkish Online Journal of Educational Technology*, *12*(4), 19–28. https://doi.org/10.1063/1.3570627

Perlis, E. (2018). The Use of Augmented Reality Technology for Primary School The Use of Augmented Reality Technology for Primary School Education in Perlis , Malaysia.

Prahbu, S. (2017). Types of Augmented Reality.

Rasalingam, R., Muniandy, B., & Rasalingam, R. R. (2014). Exploring the Application of Augmented Reality Technology in Early Childhood Classroom in Malaysia. *IOSR Journal of Research & Method in Education Ver*, *4*(5), 2320–7388.

Rasmy, M. I., Selvadurai, S., & Sulehan, J. (2017). Social Environmental Determinants of Student Dropout in the Plantation Settlement. *Malaysian Journal of Society and Spac*, *13*(2), 54–64.

Rekimoto, J. (2014). Matrix: a realtime object identification and registration method for augmented reality. *Proceedings. 3rd Asia Pacific Computer Human Interaction (Cat. No.98EX110)*, (May), 63–68. https://doi.org/10.1109/APCHI.1998.704151

Russell, A. W., Netherwood, G. M. A., & Robinson, S. A. (2015). Photosynthesis In Silico . Overcoming the Challenges of Photosynthesis Education Using a Multimedia CD-ROM, *7860*. https://doi.org/10.3108/beej.2004.03000009

Schueffel, P. (2017). The Concise FINTECH COMPENDIUM.

Srisawasdi, N., & Wangsomnuk, P. P. (2015). Examining Relationship between Biology Attitudes and Perceptions toward Mobile Augmented Reality of Photosynthesis and Impact on Gender Difference, (December).

Thalman, Nadia Magnenat, daniel T. (2012). Virtual humans : back to future.

Virtanen, V. (2014). CHALLENGES IN UNDERSTANDING PHOTOSYNTHESIS IN A UNIVERSITY INTRODUCTORY BIOSCIENCES CLASS, (October). https://doi.org/10.1007/s10763-014-9571-8

Ziegler, E. (2012). *Real-time markerless tracking of objects on mobile devices*. *Dostopno na: http://www. mobilelifecentre. org …*. Retrieved from http://userpages.uni-koblenz.de/~cg/Bachelorarbeiten/BA_Ziegler.pdf